

Gravity Recovery and Interior Laboratory (GRAIL) Mission: Mission Status and Initial Science Results

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The Gravity Recovery and Interior Laboratory (GRAIL) Mission is a component of the NASA Discovery Program. GRAIL is a twin-spacecraft lunar gravity mission that has two primary objectives: to determine the structure of the lunar interior, from crust to core; and to advance understanding of the thermal evolution of the Moon. GRAIL launched successfully from the Cape Canaveral Air Force Station on September 10, 2011, executed a low-energy trajectory to the Moon, and inserted the twin spacecraft into lunar orbit on December 31, 2011 and January 1, 2012. A series of maneuvers brought both spacecraft into low-altitude (55-km), near-circular, polar lunar orbits, from which they perform high-precision satellite-to-satellite ranging using a Ka-band payload along with an S-band link for time synchronization. Precise measurements of distance changes between the spacecraft are used to map the lunar gravity field. GRAIL completed its primary mapping mission on May 29, 2012, collecting and transmitting to Earth >99.99% of the possible data. Spacecraft and instrument performance were nominal and has led to the production of a high-resolution and high-accuracy global gravity field, improved over all previous models by two orders of magnitude on the nearside and nearly three orders of magnitude over the farside. The field is being used to understand the thickness, density and porosity of the lunar crust, the mechanics of formation and compensation states of lunar impact basins, and the structure of the mantle and core. GRAIL's three month-long-extended mission will initiate on August 30, 2012 and will consist of global gravity field mapping from an average altitude of 22 km.